# ASTRONOMICAL SOCIETY OF LONDON.

*December* 10, 1830. No. 31.

The following communications were read:—

I. On a Method of determining the Declinations of Stars with one Mural Circle, by J. Pond, Esq. A.R.

It will be recollected by astronomers, that the method employed at Greenwich for observing declinations (before a second circle was erected) consisted in determining the *mean index error* of the mural circle for considerable portions of time, and then in correcting all the observations during each portion by the index error thus found. From the great stability of the Greenwich circle, this method was the most advantageous and simple in practice; but many persons have been erroneously led to conceive that it was *essential* to that class of instruments, and that when absolute altitudes, &c. were wanted, the instrument was required to remain unchanged for many hours, or even days.

The method suggested by the Astronomer Royal is, to determine the sum and difference of two neighbouring stars, as, for instance, of *Castor* and of *Pollux*. Let the two stars be observed by direct vision on the same night, and call their difference in altitude (corrected for refraction, aberration, &c.) $d$. On any following night, let one star be observed by direct vision, and the other by reflexion. The difference of these readings (corrected as before) will give the sum of their altitudes, or $s$. The absolute altitude of each star will be respectively $\frac{s+d}{2}$, $\frac{s-d}{2}$, from which, with a knowledge of the latitude, the N.P.D. of each is immediately found.

It is almost unnecessary to remark, that, in repeating the experiment, the process may be varied by obtaining the difference of the altitudes by reflected observations, and the sum by reversing the stars. It will be noticed, that none of the divisions which enter into the first determination can possibly occur in the second; so that the determination is as practically perfect as can be attained by this instrument: moreover, it requires neither the investigation of index error, nor of horizontal points.

II. A Letter from Capt. P. King, R.N. on a Comet seen near the South Pole.

"This comet was discovered by Lieut. Wickham, of H.M.S. *Adventure*, on the night of the 18th of last March. An imaginary line from $\gamma$ *Crucis* through $\alpha$ *Crucis* to the smaller nebula, being

crossed by another from *Sirius* through the larger nebula, their intersection would be very close to the comet's position. It was very bright and large. At midnight the following angular distances were measured with a sextant.

| | | | |
|---|---|---|---|
| Comet and $\alpha$ *Crucis* ..... | 31° | 50′ | 30″ |
| ——— *Sirius* ..... | 71 | 0 | 0″ |

Three weeks after, when Captain King had arrived at the Strait of Magalhanes, the comet was too faint to be observed: it was seen near $\theta$, $\nu$, $\delta$ *Junonis Pavo*.

A notice of the same comet, from Sir Alexander Johnstone, was communicated by Mr. Baily. It was discovered by Prof. Dabadie, at the Mauritius, on the evening of the 16th of March. It was first seen between the *Chameleon* and the great nebula. The next day it had advanced about 5° towards the north, and it continued in this direction with a diminished velocity, till it reached the eastern wing of *Cygnus*, where it disappeared about the end of May. The length of its tail never exceeded 5°. Professor Dabadie had no observatory; but he made a great number of observations of its distance from several stars, and from three of these he deduced the following elements.

| | | | |
|---|---|---|---|
| Longitude of ascending node | = | 228° | 31′ |
| Inclination of the orbit | = | 49 | 46 |
| Place of the perihelion | = | 238 | 13 |
| Perihelion distance | = | 0·897 | |

Passage of the perihelion, April 11, at $21^h$
Motion direct.

The distances from which these elements are deduced are as follow: —

| | True time at Port Louis. | | | | | | |
|---|---|---|---|---|---|---|---|
| 1830. | | | | | | | |
| March 19 at | $8^h$ | $45^m$ | $50^s$ | Comet and Canopus | = | 36° | 11′ |
| | 9 | 2 | 0 | Comet and $\alpha$ Centauri | = | 34 | 50 |
| April 1 at | $16^h$ | $48^m$ | $0^s$ | Comet and $\alpha$ Centauri | = | 69° | 34′ |
| | 17 | 21 | 0 | Comet and $\alpha$ Aquilæ | = | 43 | 50 |
| April 15 at | $16^h$ | $25^m$ | $50^s$ | Comet and $\alpha$ Aquilæ | = | 21° | 50′ |
| | | 40 | 50 | Comet and $\alpha$ Centauri | = | 97 | $39\frac{1}{2}$ |

III. A letter from Sir Thomas Brisbane, with occultations of fixed stars by the moon, observed at Makerstown, lat. 55° 34′ 45″ N. long. $0^h\ 10^m\ 4^s$ W.

There are nineteen occultations observed, chiefly by Mr. Dunlop, during 1829 and 1830, for which corresponding observations are desired. "The north mark of the observatory is within sight of five of the points intersected by the trigonometrical survey, and the latitude and longitude above stated were determined by Colonel Colby, from angles which I had observed with one of Troughton's 18-inch azimuth circles, with a telescope of 30 inches."

IV. An Account of a Private Observatory, recently erected at Bedford, by Capt. W. H. Smyth, R.N.

After a mature consideration of the objects he had in view, Capt. Smyth decided upon the following plan of an observatory:—A meridian instrument room, 17 feet long, 12 broad, and 10 high; and on the west of this, a circular room, 15 feet in diameter, for an equatorially-mounted telescope. The situation is favourable, upon a hard bed of gravel, at a convenient distance from roads, &c., and commanding the passage of Fomalhaut to the south, and Capella S.P. to the north, clear of all obstructions.

The meridian room contains—

1. A dead-beat clock, with a mercurial pendulum. The wheel-work has been constructed with singular care: the steel rod *plunges* into the mercury, thus insuring a uniformity of temperature between the cistern and the rod, and is further secured from partial variations by a covering of brass tube. A "noddy" is placed upon the clock, to verify the steadiness of its supports.

2. A transit telescope, of 3½ feet focal length and 3·25 inches aperture, supported upon piers of Portland stone, 5 feet 7 inches above the floor, which, with their bases, each weigh a ton. The Y's are faced with Brazilian pebble, and rest, by a hemispherical base, upon corresponding sockets; so that the bearing is true along the whole of the pivot. There are five wires in the principal focus, and a sliding eye-piece. Two divided circles, of 6 inches diameter, are attached to the eye end, for *setting* the telescope. This instrument, with the accompanying level, are said by Capt. Smyth to stand the utmost scrutiny. In the meridian, at about 50 feet distance, is placed a deep-sunk pier, upon which a piece is fixed, carrying, as a mark, a small silver circle with a black dot in the centre. Distinct vision is obtained by interposing a 4-inch lens, of 49½ feet radius, fixed into the wall of the transit room. From the convenience and utility of this mark for collimating and adjusting, Capt. Smyth strongly recommends its adoption as a companion or substitute for a distant meridian mark.

3. The beautiful circle of 2 feet diameter, telescope 30 inches, made by Mr. Troughton, and presented to the Society by Dr. Lee. The divisions are by dots, on gold, to every five minutes, subdivided by two horizontal microscopes to seconds. This is accompanied by levels, plumb-line, and ghost apparatus. The whole stands on a massive stone, of nearly two tons weight, bedded on masonry descending to the firm substratum of gravel. To add to its power, a horizontal floating collimator is placed in the south wall, and immediately above the circle two horizontal beams, stretching across the observatory, support a large *vertical* collimator, which slides upon friction-rollers on an iron railway, when required to be removed from the zenith. These were constructed by Mr. Robinson, under Capt. Kater's personal inspection. A barometer, thermometers, &c. complete the furniture of this room.

The circular room is covered by a conical roof, furnished with the requisite openings, and resting upon three iron balls. This

room contains the equatorially-mounted telescope. The polar axis is formed of four thick slabs of mahogany, strongly braced together, and terminating in large bell-metal pivots. The telescope, and the declination circle of 3 feet diameter, are carried by a stout axis passing through the centre of the polar axis, and are counterpoised by a ball of lead. The hour circle is of the same dimensions as the declination circle; it reads both time and space, and is fitted with a very efficient clamp and endless screw, to which a clock-work motion may be applied. The whole of the movements are remarkably easy; so that the telescope may be moved in any direction by the finger; nor is there as yet any flexure to be detected in the axis, or expansion in the supports. This is by Mr. Dollond.

The object-glass of the telescope is of $8\frac{1}{2}$ feet focal length, with a clear aperture of $5\frac{9}{10}$ inches, worked by the late Mr. Tulley, from a disc purchased by Sir James South at Paris. It is considered by Capt. Smyth to be the finest specimen of that eminent optician's skill, and will bear with distinctness a magnifying power of 1200. To this are applied a double-line position micrometer, a rock-crystal micrometer, &c.

"In giving this high character of my telescope, it is proper to state, that I have tried its light by the cluster in the sword-handle of Perseus, by several of Messier's nebulæ, and by resolving portions of the Via Lactea into stars. Its distinctness is proved by the ready vision of the companions of Polaris, Rigel, $\alpha$ Lyræ, and $\alpha$ Capricorni, and also by the facility with which $\lambda$ Ophiuchi, $\sigma$ Aquarii, $\theta$ Persei, $\mu$ Cephei, $\delta$ Serpentis, $\zeta$ Herculis, and $\varepsilon$ Bootis, are seen double; $\zeta$ Orionis and $\xi$ Libræ triple; $\beta$ Capricorni quadruple, and $\sigma$ Orionis multiple. Lastly, I estimate its general action by the lunar montains, cavities, and shadows, under all powers; the lucid polar regions of Mars, the sharpness of the double ring of Saturn, the gibbous aspect of Venus, the shadows of Jupiter's satellites across his body, the splendid contrast of colours in $\alpha$ Herculis, $\gamma$ Andromedæ, and other superb double stars; and the comparative facility with which such tests as $\sigma$ Coronæ Borealis, $\tau$ Aquarii, $\theta$ Virginis, $\eta$ Bootis, and $\delta$ Equulei, admit of measurement. It may not be uninteresting to add, that, in consequence of a letter from Mr. Herschel, I examined the remarkable orbital change of quadrant which has occurred in $\sigma$ Coronæ since 1825, and that I have had a fair comparison with him in measuring the position and distance of $\delta$ Equulei to very considerable accuracy."

All the piers on which the instruments are placed are carried down to the solid gravel, and are clear of the floor, &c. The ground outside the observatory has been cleared away for the space of 10 feet, and the vacancy filled up with brick and gravel.

For meteorological observations, which have been in this country hitherto much neglected, the Bedford Observatory is provided with a rain-gage, evaporator, hygrometer, and weather-cock.

The objects to which Capt. Smyth first applied himself were the determination of the latitude and longitude of his observatory.

For the latitude, two independent methods were adopted; that of observing the zenith distances of known stars, the zenith point being determined by the *collimator;* and that of the zenith distances of Polaris above and below the pole, in reversed positions of the instrument, using the plumb-line and level apparatus.

Of the collimator, Capt. Smyth remarks—"Having experienced much loss of time, when on public service, from the necessity of awaiting consecutive periods for completing observations, I resolved to give Capt. Kater's vertical collimator a strict trial as a zenith point. In using it with the Beaufoy circle, I was much pleased with its action; for the convenience of each altitude being complete in itself without reversion, constitutes an invaluable quality. In the fifteen months which elapsed between taking down one circle and working the other, the collimator was covered up, on account of the dust occasioned by the workmen. Yet, soiled as it necessarily became, when it was occasionally uncovered for examination by astronomical friends, it constantly found as rigid a zero as before the interruption. In the annexed observations it will be seen, that the inclination of the floating optical axis was purposely varied by weights, without at all affecting the final deductions. The instability of levels, and the difficulty of pronouncing a plumb-line either perfectly straight or cylindrical, are universally acknowledged. The principal claim of the collimator to regard is, that, by its azimuthal motion of 180°, it shews the amount of the error of collimation in altitude, and of any deviation in the circle's vertical axis, and thus gives the means of yielding a complete and final result for every single observation.

"On the whole, from witnessing that it possesses sufficient stability for its time of action, I have arrived at the conclusion, that this powerful appendage, whether used above or below, will, in the end, be deemed an integral part of every meridian circle; that its cheapness, portability, and facility of correction, render it highly desirable and available to officers and others employed on scientific missions; and that its results harmonise in a more remarkable degree than by the usual means of level, or plumb-line, taken with twice the time and trouble. And when all the obstacles to the extensive use of reflection are considered, the collimator presents advantages too obvious to be overlooked."

Capt. Smyth then gives sixty observations of standard stars, for each of which the zenith point was determined by the collimator, and deduces from the mean of the whole.

| | |
|---|---|
| The latitude of the Bedford observatory ..... | 52° 8′ 25″,45 |
| By eight observations of Polaris, above and below pole, face east and face west, instrument adjusted by the plumb-line and levels..... | 52 8 29 ,71 |
| Mean..... | 52 8 27 ,58 N |

From six observations of the moon and moon-culminating stars,

half of the first and half of the second limb, and compared with corresponding Greenwich observations,

| | | |
|---|---|---|
| The longitude of the Bedford observatory | = | $1^m\ 51^s{,}975$ West. |
| From four *corresponding* occultations ... | | $1\ \ 51\ ,486$ |
| From thirty-eight *non-corresponding* occultations and eclipses of Jupiter's satellites ..... | | $1\ \ 47\ ,948$ |

Capt. Smyth is inclined to adopt, for the present, $1^m\ 51^s{,}7$.

The occultations were computed from a formula investigated by Mr. Maclear.

*** *This Number terminates the First Volume of the Monthly Notices.*

J. MOYES, TOOK'S COURT, CHANCERY LANE.

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